

ENVIRONMENTAL MANAGEMENT SYSTEM FOR SMALL AND MEDIUM SIZED ENTERPRISES

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Abstract. Environmental management system is a systematic approach to planning, controlling, measuring and improving an organisation's environmental efforts. Management system can be applied in service, public and industrial sectors. In this study, environmental management system (EMS) for small and medium sized enterprises (SMEs) are investigated as a project supported by Istanbul Association of Manufacturers. SMEs are defined as the enterprises where 5-50 people work and are selected to represent almost every category defined in standard industry classification. Survey of enterprise processes supported with a questionnaire form used to figure out environmental performance and enables to define key elements of each sector. Finally, key elements of environmental management system for SMEs are presented in a table form. A model developed for SMEs including environmental aspects are presented.

Keywords: environmental management system (EMS), small and medium sized enterprises, environmental aspects, modelling.

AIMS AND BACKGROUND

Environmental management systems can be applied to industry, services and public sectors. Services and public sectors include hotels, hospitals, governmental organisations, and educational activities¹⁻³. But the most common implementation area of EMS is among the various industrial applications⁴. In all industries, small and medium sized enterprises have very important role in production area as well as causing environmental pollution. Assessment of environmental aspects of SMEs will have a vital role in adopting environmental management system. EMS are based on industrial application and understanding that its components are the most important part of the system.

ENVIRONMENTAL MANAGEMENT SYSTEM

An environmental management system is a systematic approach to controlling the environmental effects of an organisation's activities. Unlike a pollution control

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standard, an EMS standard does not set specific pollution targets, but establishes the required elements of an effective system.

Environmental management covers such general areas as environment and enterprise objectives, scope and structure of environment, interaction of nature, society and the enterprise, environmental impact assessment, economics of pollution prevention, etc.; such project areas as project development, implementation, monitoring and evaluation, and such production areas as production management and the environment, product design, technology choice, waste management and production systems⁵⁻¹¹.

Benefits of an EMS can be summarised as:

- improved environmental performance;
- improved compliance;
- new customers / markets;
- increased efficiency / reduced costs;
- enhanced employee morality;
- enhanced image with public;
- reduced training effort for new employees;
- enhanced image with regulations.

INDUSTRIAL ENVIRONMENTAL MANAGEMENT SYSTEM

Industrial management systems have two main management processes:

- resource management;
- waste management.

Waste management. Definition of wastes can be described mainly in three forms, namely liquid wastes, air wastes and solid wastes. Beside these, more wastes can be found as micropollutants, hazardous materials, noise pollution, air emission, medical wastes.

Resource management. From the environmental point of view, wastes and waste management are the most important factors and there is a strong relation between resource management and waste management. Well-managed environmental resources minimise the amount of waste from that resource. Resources include all living and non-living components and the most important one is the human resource. Resource Conservation and Recovery Act which has been enacted in 1976 is a very important law in the environmental legislation.

The main inputs of an industrial system are raw materials and energy. These non-living resources include renewable and non-renewable sources. Non-renewable sources include mine, fuel, fossil, coal, etc., while renewable sources include human, wind energy, etc.

The relationship between resource management and environmental protection are described below:

- precautions to decrease waste pollution load;
- energy;
- technology selection to prevent by-products;
- waste minimisation by good housekeeping;
- life cycle assessment;
- environmental friendly product;
- occupational health and safety;
- environmental education;
- environmental monitoring and audit.

Inputs and outputs of an industrial system are described in Fig. 1. Non-product outputs of the system (wastes) are also shown in the figure. Management concept of an industry is described in Fig. 2.

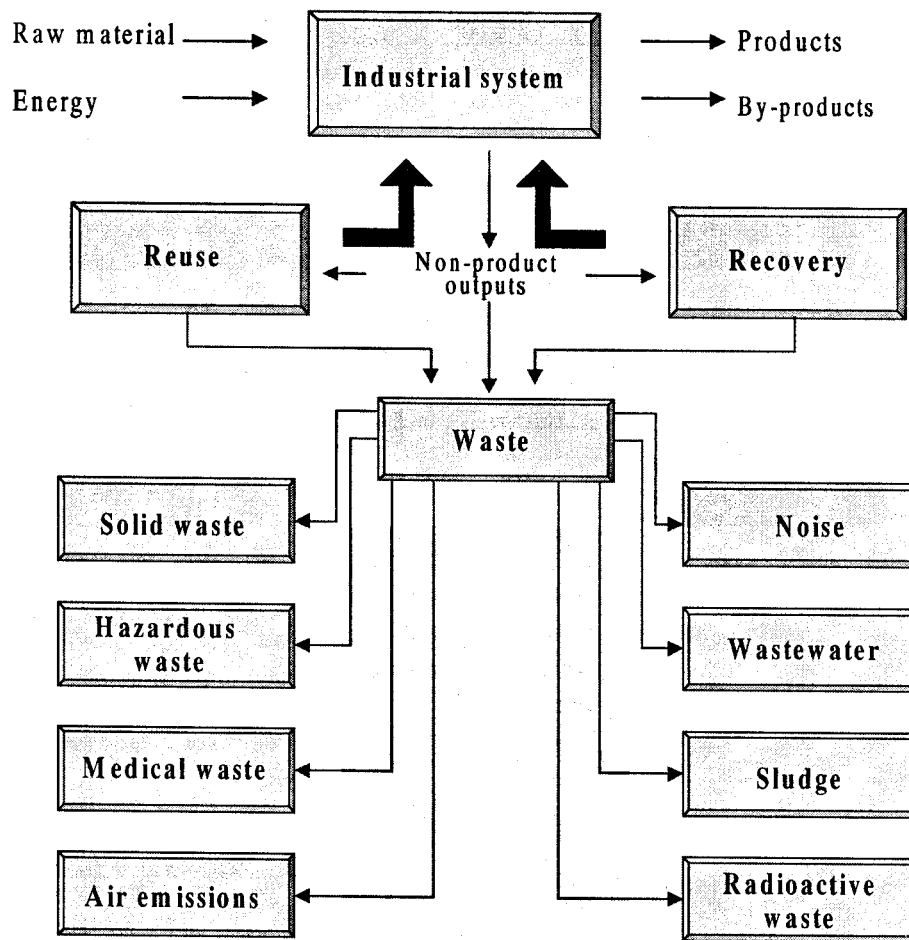


Fig. 1. Input and output in an industrial system

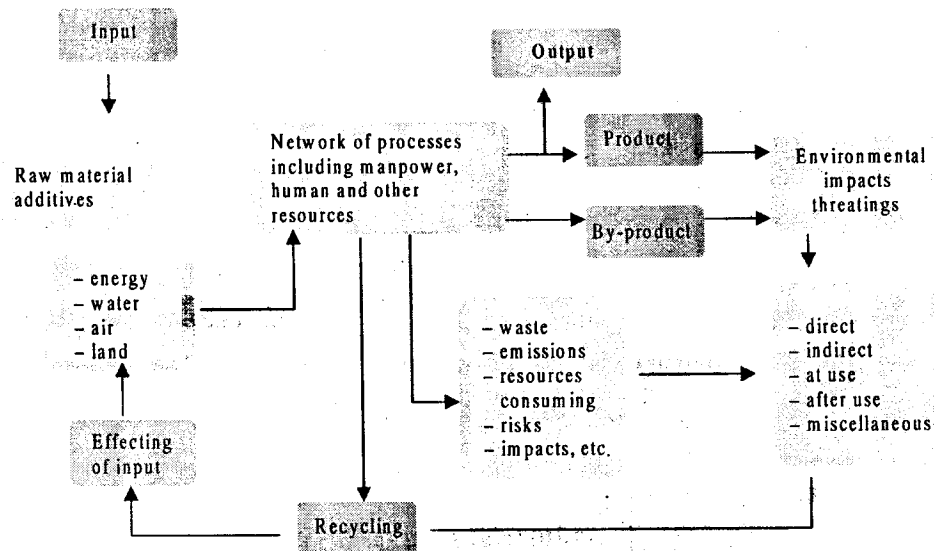


Fig. 2. Management concept of an industry

DESCRIPTION OF THE STUDY

The study was a pilot study for description of key elements of environmental management system (EMS) for small and medium sized industries. This study is carried out by Istanbul Technical University for six months as site investigations.

There are 22 industries (registered at ISO) selected as pilot for EMS projects. During the selection, the most important factor for the industries was to find representative industry among their category. Table 1 describes the pilot industries and their classification according to SIC codes (Standard industry classification) and ISO classification.

There are many definitions about SMEs and there is very little consistency among these definitions. Most of them define SMEs based on their employee numbers, turnover or balance sheet total and ownership. In this study the definition of ISO is used which defines the SMEs only according to their number of employee as SME has less than 50 employee^{6,7}.

Table 1. Selected SMEs for EMS pilot project

No	SIC categories
1	food and kindred products
2	electrical and electronic equipment
3	printing and publishing
4	primary metal industries
5	fabricated metal products
6	rubber and miscellaneous plastics products
7	electrical and electronic equipment
8	apparel and other textile products
9	miscellaneous manufacturing industries
10	fabricated metal products
11	fabricated metal products
12	chemicals and allied products
13	leather and leather products
14	chemicals and allied products
15	nonmetallic minerals
16	wholesale trade - durable goods
17	leather and leather products
18	nonmetallic minerals
19	lumber and wood products
20	food and kindred products
21	chemicals and allied products
22	rubber and miscellaneous plastics products

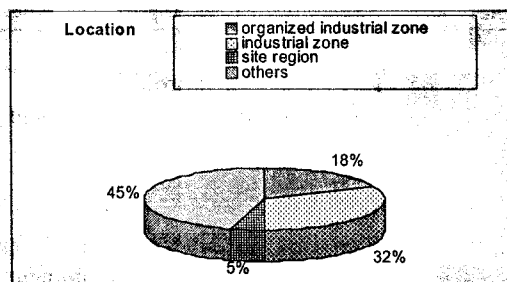
DATA COLLECTION FROM INDUSTRIES

In order to collect data from SMEs for this project, a questionnaire form was prepared. The questionnaire form covers the following categories: environmental performance, regulatory compliance, environmental conditions, pollution prevention. Project team has filled out questionnaire forms during the site visit of each enterprise. An extensive survey of process was done to figure out environmental performance of the enterprises. Questionnaire forms were also used to evaluate an environmental inventory of the SMEs. This inventory includes:

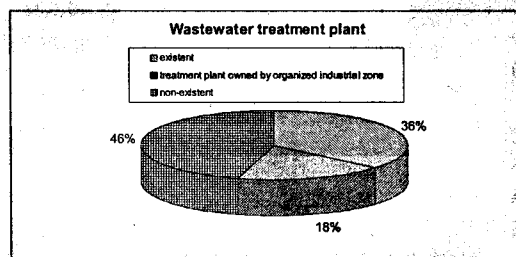
- environmental policy;
- environmental performance;
- resource management;
- waste management;
- OSHA;
- environmental training.

Questionnaire forms enable us to make a statistical evaluation. Some sample statistical figures are described below.

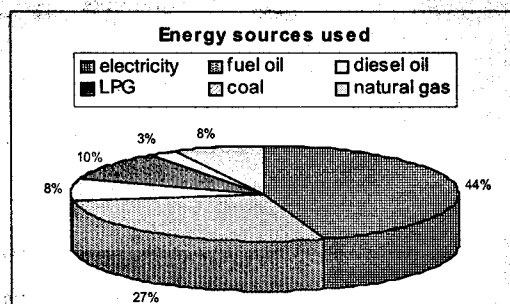
Location	
Organized industrial zone	4
Industrial zone	7
Site region	1
Others	10
Total	22



Wastewater treatment plants	
Existent	8
Treatment plant owned by organized industrial zone	4
Non-existent	10
Total	22



Energy sources used	
Electricity	18
Fuel oil	11
Diesel oil	3
LPG	4
Coal	1
Natural gas	3
Total	22



KEY ELEMENTS OF EMS FOR SMEs

The key elements of environmental management system for SMEs are described in Table 2. Non of the investigated SMEs has a certificated EMS under ISO 14 000 (Refs 6, 7) or EMAS and only one of them has ISO 9000 qualification certification.

White cells describe the activities that a company must undertake. All companies must prepare an environmental policy, control natural sources, occupational safety and health, environmental monitoring, and prepare documents and emergency plans.

Waste management is very important for all enterprises. As far as process survey results show, some environmental impacts due to wastes are very important while others have less importance. These differences are pointed out in the Table will different legends. White cells in waste management area show the areas that

an enterprise must undertake, while grey cells show wastes that can be controlled. The rest of the cells show that there is no impact of these activities for this category.

RESULTS AND DISCUSSION

The results for a model development for SMEs are determined by pilot study and the developed model is given in Fig. 3. Since the evaluation of environmental aspect with its surroundings is the most important part for EMS, the model will help SMEs to develop their own management system.

- Compliance with regulation requirements and permits should be provided for each enterprise according to their location area;
- Enterprises have to analyse their production processes. Mass balances of each production processes should be evaluated with all inputs and outputs;
- Enterprises evaluate their combined and separated waste categorisation or define their emissions;
- Pollution profile of surroundings of each enterprise has to be determined with the help of detailed analysis of process and waste surveys. Pollution loads to the environment are to be determined for both before and after precautions;
- In the final step, enterprises should develop a management system including objectives and targets, based on obtained data from process and waste survey;
- Enterprises periodically should monitor itself in a sustainable and valid audite.

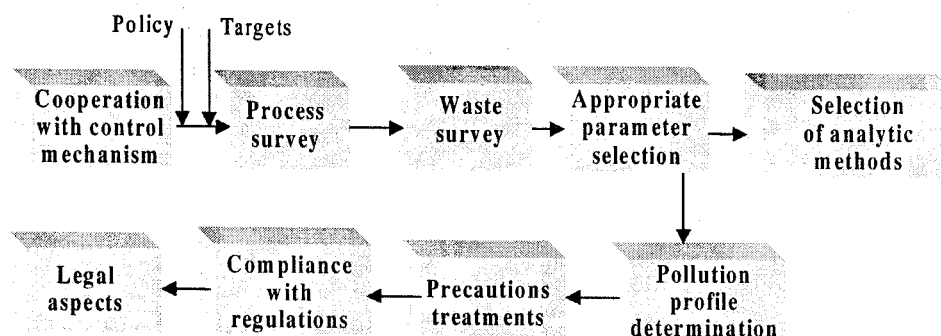


Fig. 3. Basic steps of EMS for SMEs

Enterprises should have an environmental protection policy to start environmental management system.

Documentation, procedure writing, emergency plans, internal audits, environmental training and awareness of employee should be provided by each enterprise to implement the management system.

Table 2. Key elements of SMEs for EMS

No	Environmental policy	Waste water	Air emissions	Indoor emissions	Solid waste	Hazardous wastes	Noise pollution	Sludges	Natural sources	OSH	Environmental documents	Monitoring	Emergency plans
1													
2													
3													
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Based on the above defined model, implementation of EMS evaluated according to appropriate analyses will help to correct environmentally regulative disabilities and contradictions.

The most appropriate management for SMEs will be first adopting the EMS to enterprise, then trying to compliance to environmental regulations.

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